

Local Food AI - Architecture Map

This document describes the technical architecture, database schema design, AI RAG data flows, and dual-mode deployment topology for the Local Food AI clinical dietitian platform.

System Component Architecture

The platform is designed around a strictly local, privacy-first microservice topology. The components integrate seamlessly to provide nutritional search, RAG-augmented clinical diet evaluations, and DevSecOps observability.

```
graph TD
  subgraph "Client Layer"
    User["User Browser"]
  end

  subgraph "Application & Gateway Layer"
    Nginx["Nginx Reverse Proxy\n(Port 80)"]
    Streamlit["Streamlit Web App\n(Port 8502)"]
  end

  subgraph "Intelligence & RAG Layer"
    Ollama["Ollama Engine\n(Mistral / Llama 3.2)\n(Port 11434)"]
    SearXNG["SearXNG Anonymous Search\n(Port 8080)"]
  end

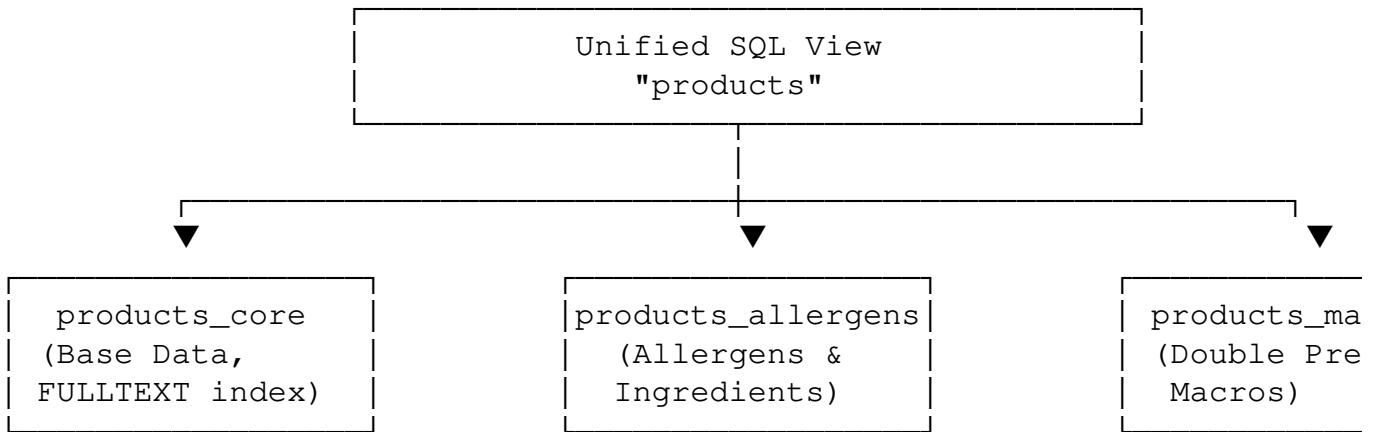
  subgraph "Database & Storage Layer"
    MySQL["MySQL Database Server\n(Port 3307)"]
    Alembic["Alembic Migrations"]
  end

  subgraph "Observability & Telemetry"
    Zabbix["Zabbix Server & Web Dashboard\n(Ports 8081 / 10051)"]
    SNMP["SNMPv3 Trap Agent"]
  end

  %% Connections
  User -->|HTTP| Nginx
  Nginx -->|Proxy Pass| Streamlit
  Streamlit -->|Vector / Chat Queries| Ollama
  Streamlit -->|Fallback Search| SearXNG
  Streamlit -->|EAV & Core Queries| MySQL
  Alembic -->|Database Schema| MySQL
  Streamlit -->|Encrypted Telemetry Traps| SNMP
  SNMP -->|SNMPv3 Traps| Zabbix
  MySQL -->|Performance telemetry| Zabbix
```

Database Design: Grouped Vertical Partitioning

To optimize massive dataset ingestion (~24GB OpenFoodFacts dataset) and completely bypass InnoDB row size limits while maintaining sub-second RAG response times, the database utilizes a vertically partitioned structure:



1. **products_core**: Contains product base information (barcode, name, brand, primary category) optimized with FULLTEXT indexing.
2. **products_allergens**: Isolates complex ingredient list arrays and allergen keywords.
3. **products_macros**: Implements double-precision floats (DOUBLE) for protein, carbs, fats, and energy metrics.
4. **products_vitamins**: Stores micronutrient vitamin profiles.
5. **products_minerals**: Stores trace mineral concentrations.

[!NOTE] All application search queries, RAG data tools, and ingestion processes interact with a unified database **VIEW** named `products` which uses a series of high-performance `LEFT JOIN` operations across the primary key (barcode), shielding the frontend from database complexity.

🌐 Dual-Mode Deployment Topology

To ensure 100% resilience under network restrictions, the Local Food AI system is architected to operate under two distinct networking modes:

1. Mixed Distributed Topology (Production/Staging Mode)

Services are distributed across specialized local hypervisors and Windows subsystems using bridged networking:

- **Application Node (WSL 2)**: Runs the Streamlit frontend and local Ollama model engine.
- **Database Node (Hyper-V VM)**: Dedicated Ubuntu instance hosting the relational MySQL partitions at `192.168.130.170`.
- **Monitoring Node (VirtualBox VM)**: Dedicated host running Zabbix Server and receiving SNMPv3 notifications.
- **Agile Scrum Tracker (Taiga)**: Remote agile project server at `192.168.130.161` for syncing deliverables.

2. Resilient Single-Node Local Fallback (Offline Mode)

When the remote VM host network or Taiga server is completely unreachable:

- **Zero-Dependency Containers:** The entire platform runs entirely locally on the notebook host via **Docker Compose** (`docker-compose.yml`).
 - **Automatic IP Resolution:** Application configuration, Alembic, and SNMP notifications automatically adjust their endpoints to target local network interfaces (`localhost` / custom Docker networks) rather than unreachable remote IPs, avoiding timeout hangs or crashes.
 - **Dynamic Task Tracking:** Agile development logs are dynamically synced into the workspace `[task.md](file:///C:/Users/lanfr144/Documents/DOPRO1/Antigravity/Food/task.md)` and `[walkthrough.md](file:///C:/Users/lanfr144/Documents/DOPRO1/Antigravity/Food/walkthrough.md)` artifacts to track progress until connectivity is restored.
-

Documented by Antigravity.